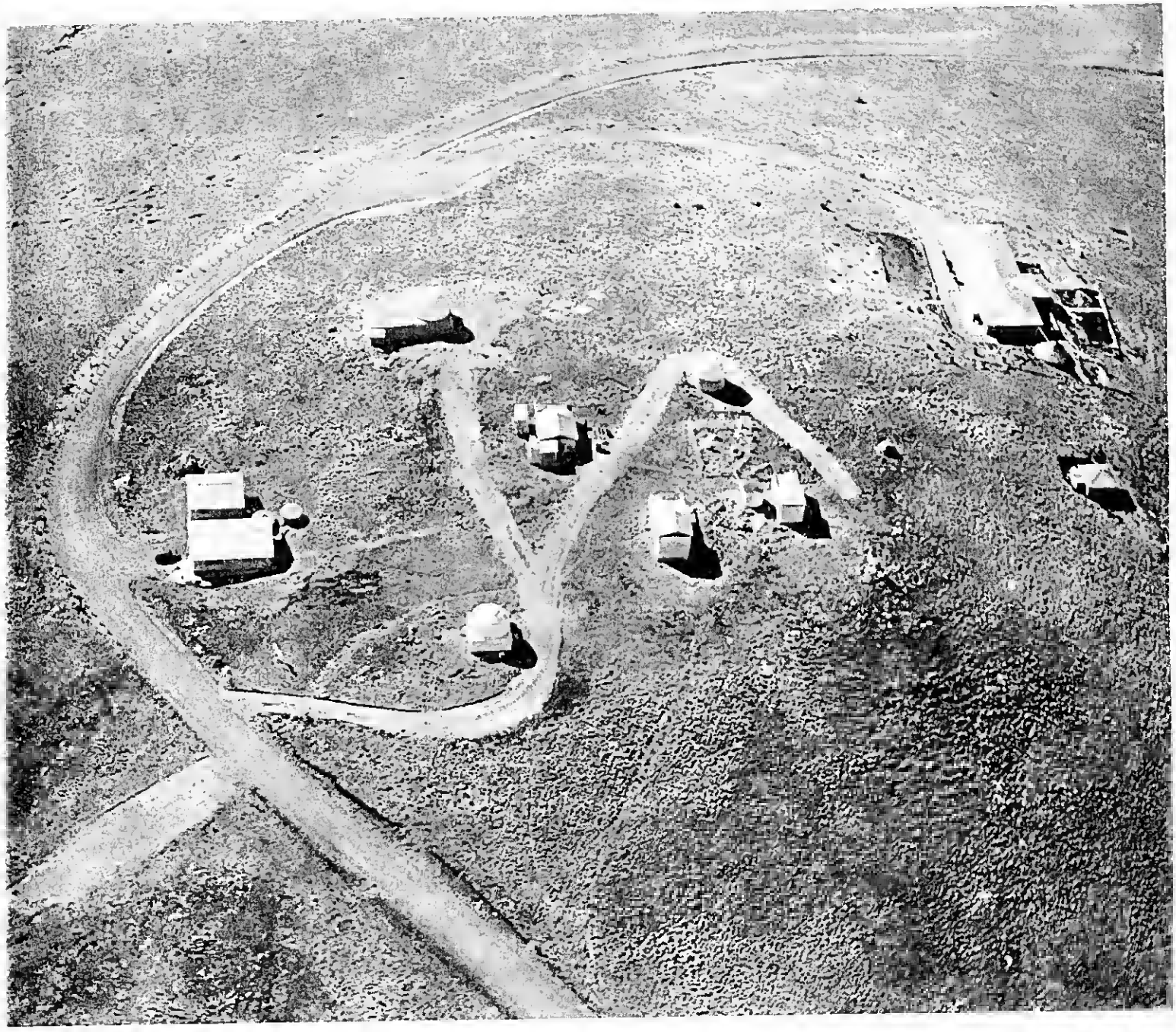
MOUNT JOHN UNIVERSITY OBSERVATORY

LAKE TEKAPO, NEW ZEALAND.



DEPARTMENT OF PHYSICS, UNIVERSITY OF CANTERBURY,

CHRISTCHURCH, NEW ZEALAND.

CONTENTS

MOUNT JOHN UNIVERSITY OBSERVATORY
LAKE TEKAPO, NEW ZEALAND.

Mount John University Observatory is at present the principal centre for the development of optical astronomy in New Zealand. New Zealand's largest reflecting telescopes and largest astrographic cameras are sited on the peak of the mountain. The Baker-Nunn Satellite Tracking Station, operated by the Bendix Field Engineering Corporation, is a separate installation also situated at Mount John half a kilometre to the south of the observatory.

1. THE PARTICIPATING UNIVERSITIES AND ASSOCIATED INSTITUTES.

The Observatory is owned by the University of Canterbury, Christchurch, and operated for research in astronomy and astrophysics by the Department of Physics in collaboration with the Department of Astronomy of the University of Pennsylvania and the Department of Physics and Astronomy of the University of Florida. An Optical Craftsmen 610mm reflector was installed by Pennsylvania at the Observatory in January 1970. During 1975 Pennsylvania renewed their formal association which dates back to the opening of the Observatory in 1965. The installation in 1975 by the University of Canterbury of another more versatile 610mm Boller and Chivens reflector and the doubling since 1971 of the academic and technical staff employed by Canterbury makes it at present the principal contributor and user of the Observatory

The Remeis Observatory in Bamberg, West Germany, has been informally collaborating with the participating Universities, particularly Florida and Canterbury since 1970, with some of the Observatory programmes. Another major North American observatory, the Lick Observatory situated at Mount Hamilton in California was associated with the early stages of an extensive programme at Mount John. This led to the production of the Mount John University Observatory Photographic Sky Survey and the publication in Christchurch of the Canterbury Sky Atlas.

As research astronomy has developed in other New Zealand universities and institutions and as the Canterbury contribution to Mount John has become the major one the facilities have

increasingly been made available to New Zealand observers not employed at Canterbury.

The Department of Physics at Victoria University of Wellington has used the Observatory annually since 1972. The Department of Physics of the University of Otago have adapted accessories for use at Mount John and are now using the Observatory on a monthly basis both on joint programmes with Canterbury and for their own research. An observing group from the University of Auckland has been invited to apply for time on the telescopes. Alan Gilmore, of Carter Observatory, will continue his programmes when he leaves Carter (October, 1975) and when his research needs it will have access to telescopes with high precision tracking available at Mount John. His comet and asteroid research will continue to be coordinated with similar work at Mount John.

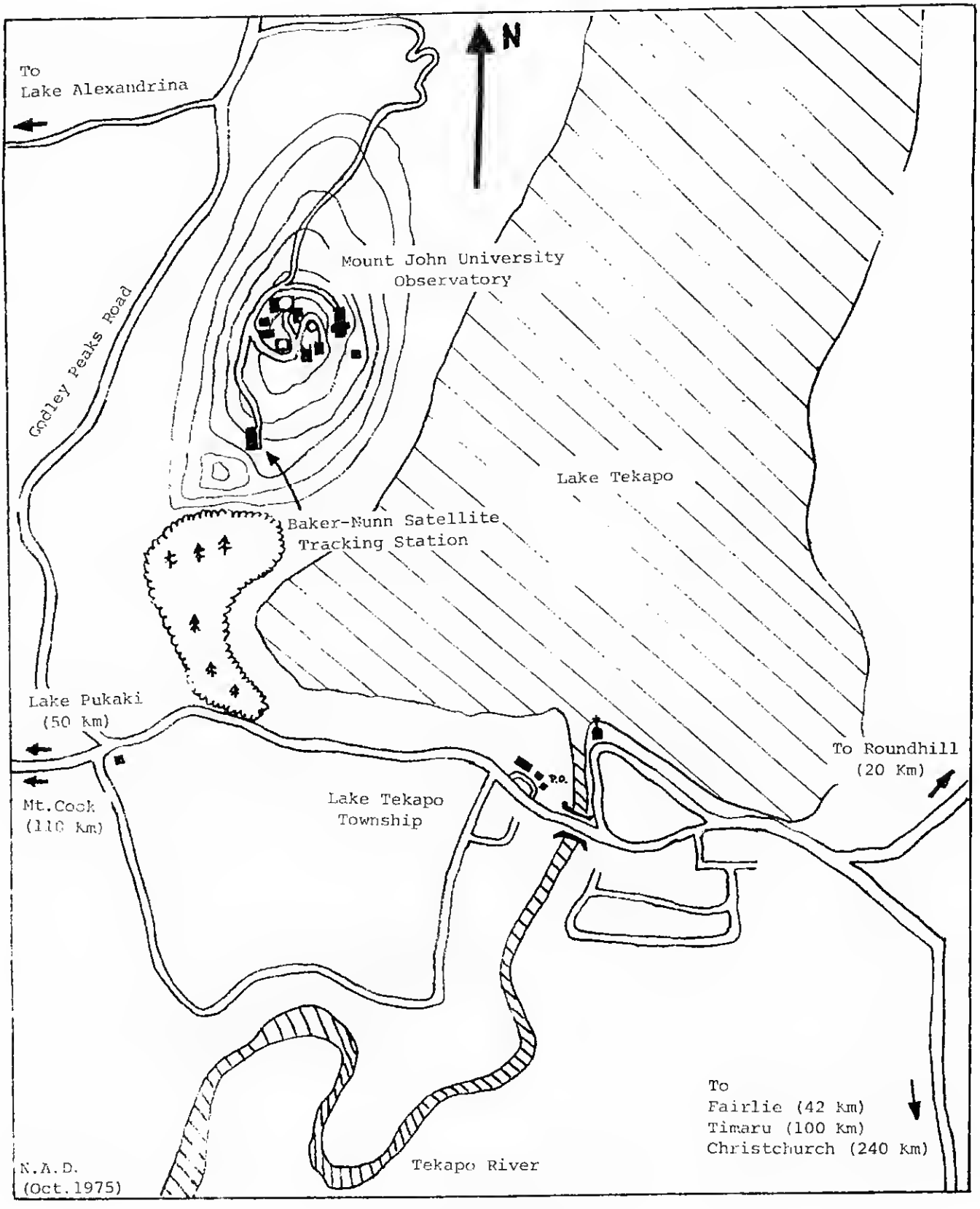
2. ADMINISTRATION.

Observatory policies in general are formulated by an Advisory Committee of representatives of the Universities of Canterbury, Pennsylvania and Florida. The day-to-day administration of the Observatory and the operation of the telescopes is the responsibility of the Department of Physics of the University of Canterbury. Prospective users of the telescopes at Mount John should apply for telescope time to the Head of the Department of Physics and such applications will be considered from any research observer from within New Zealand or overseas.

3. GEOGRAPHICAL DATA.

The Observatory is sited on the peak of Mount John near the shores of Lake Tekapo in South Canterbury, at an altitude of 1029 metres (3876 feet) as shown on the accompanying location map.

Mount John rises steeply to about 300 metres (1000 feet) above the relatively flat surrounding Mackenzie Basin. Situated at a longitude of 189° 32' 06" West and a latitude of 43° 59' 14" South, it is the most southern optical research observatory in the world. Christchurch is 240 kilometres away



Location Map

Mount John University Observatory

by road. Being far from all cities and towns, except for the township of Lake Tekapo at the foot of the mountain, the Observatory is essentially free from all urban or suburban effects on the quality of the extremely dark and steady skies frequently observed. The Mackenzie Country is partly encircled by mountains, some of which rise to about 3000 metres (10,000 feet) in the Southern Alps to the north-west. Nearby areas outside the Basin often have bad weather while at the same time observing at Mount John is of sufficient quality to obtain excellent sky photographs or accurate measurements of the brightness and colour of stars with photo-electric, photographic and spectroscopic detectors.

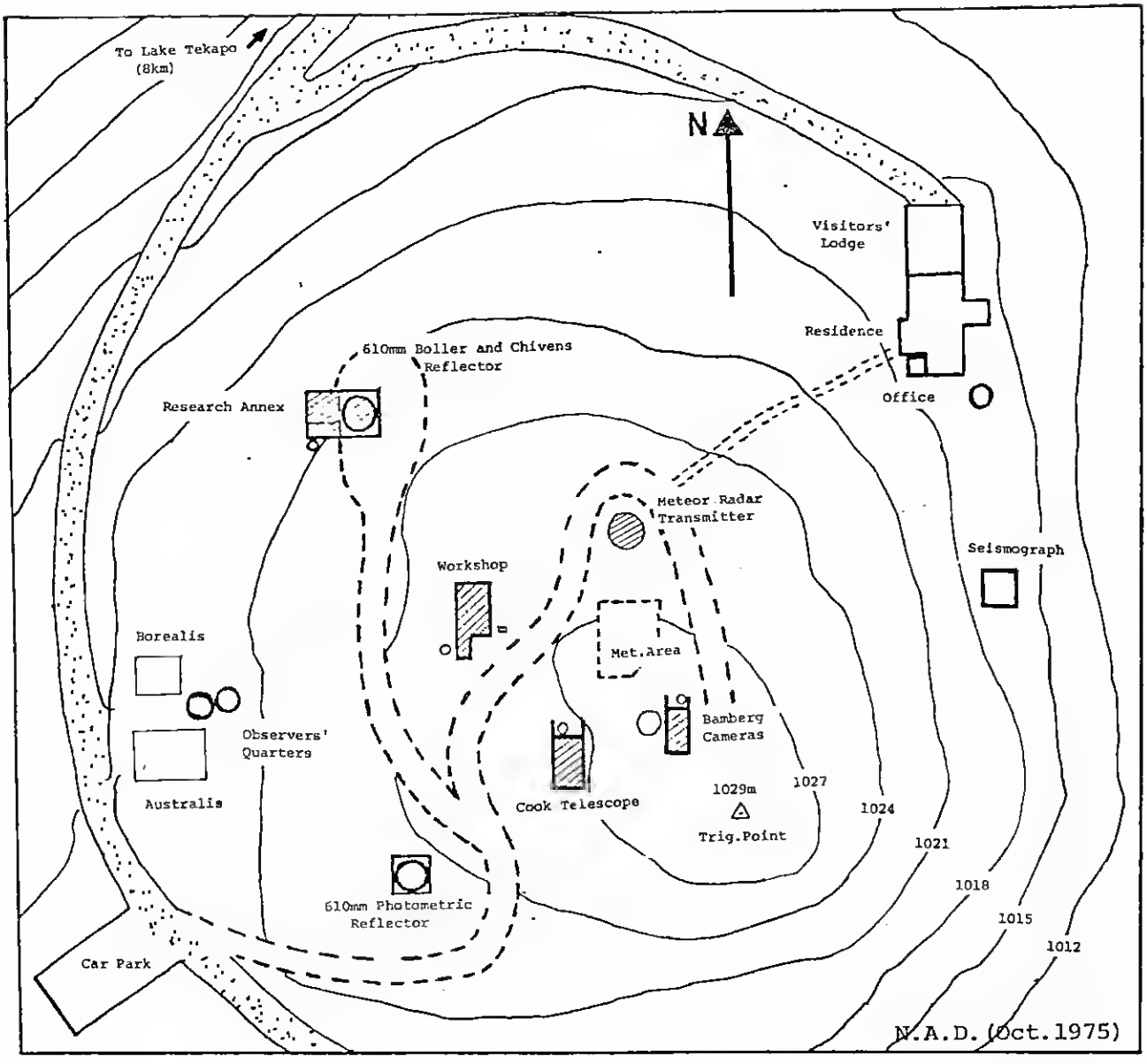
4. FACILITIES.

The cluster of ten buildings at the Observatory are linked by 8 kilometres of road to all essential services in Lake Tekapo township. Over half this road including all of that which is not on the flat is sealed. Transport to Lake Tekapo, Fairlie, Timaru and Christchurch is provided by an all-weather four-wheel-drive vehicle which also serves as a snow-plough, if necessary, during winter. The water is supplied by pumping from Lake Tekapo to adequate storage reservoirs at the peak, sufficient also for fire prevention measures. Power and telephone services to the observatory can be extended as needed to meet any growth of the facilities. The ten buildings house telescopes, auxiliary equipment, dark-rooms, accommodation and workshops as shown in the accompanying site plan. The purchase in 1975 of two sections in Lake Tekapo township will add to the accommodation facilities for resident staff.

5. THE TELESCOPES AT THE OBSERVATORY.

The principal telescopes are the two 610mm reflectors.

5.1 The most versatile telescope is the Canterbury owned and operated 610mm (24-inch) Boller and Chivens Reflector installed in 1975. This sophisticated, very high quality instrument is capable of carrying accessory equipment in excess of 225kg (500 lb) at the Cassegrain focal position.



Site Plan

Mount John University Observatory

A 300mm (8-inch) refractor by Nankivell (D.S.I.R.) and Kershaw (Canterbury) is attached as the guide telescope. The telescope can be operated at the prime focus if required. It is mounted in a building with adjacent rooms for electronics, photographic processing and chart-reading.

5.2 The second instrument is the 610mm (24-inch) Photometric Reflector designed by Optical Craftsmen and installed by Pennsylvania in 1970 for photometric operation. Its primary auxiliary equipment is the photoelectric system for observations in selected wavelength bands, the output going to an integrated data-logging system.

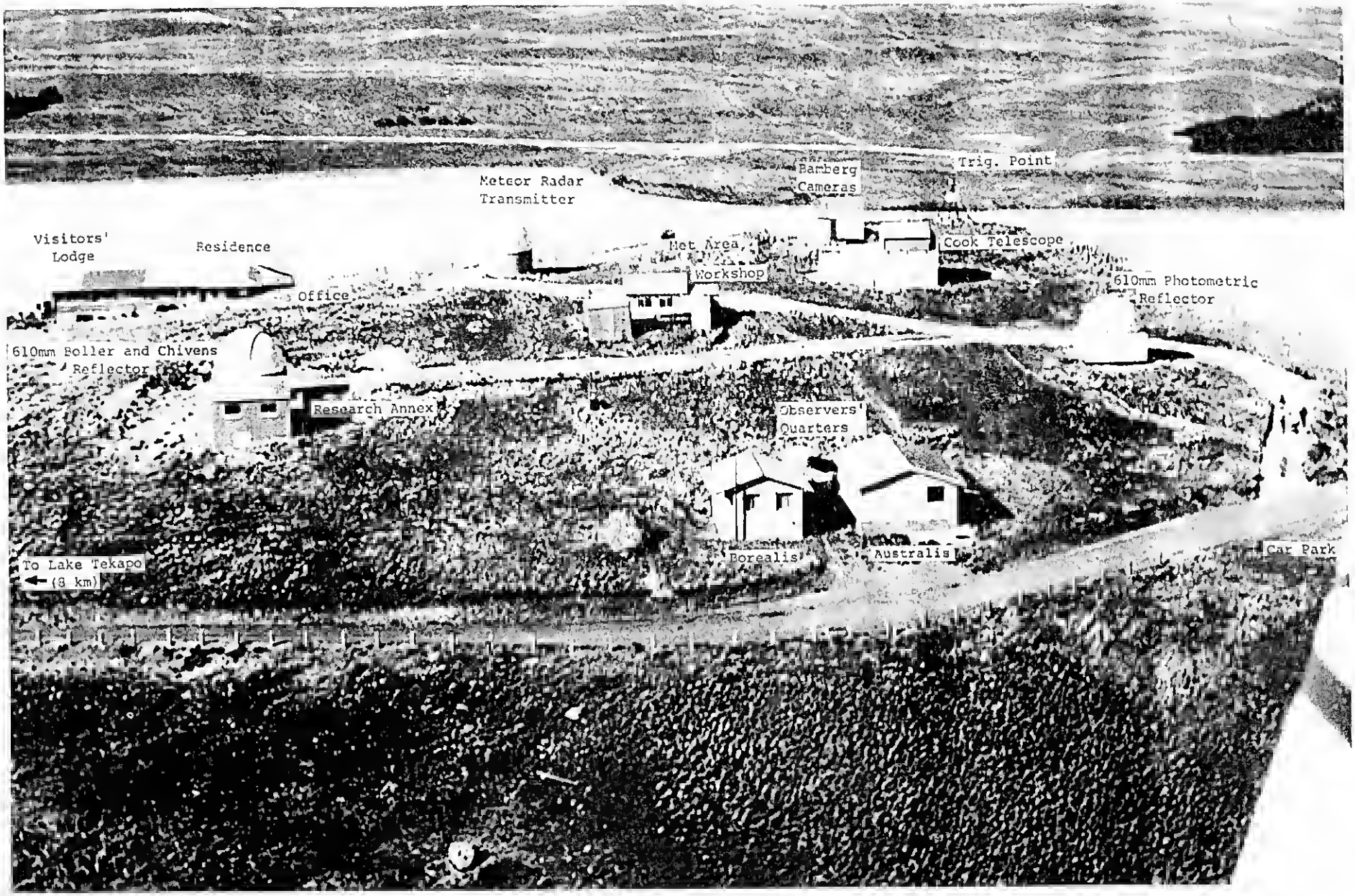
5.3 The Cook Telescope carries three f/7 astrographic cameras on a single mounting, the apertures being 100, 125 and 250mm (4, 5 and 10 inch). Various photographic plate and film formats are available including the operation of a stepped or continuous 35mm film sequence. The 125mm f/7 Ross lens is the Survey Astrograph used for the Sky Survey and the Canterbury Sky Atlas, now used throughout the world.

5.4 The Bamberg Cameras consist of four 100mm f/7 astronomical cameras on a single mounting. Each camera may be directed to a selected declination on a particular hour angle. The operation of the cameras is self-contained with a dark-room attached to the same building. Plates are used in discovering variable stars, comets and asteroids. Comet Clark 1973i is named after the observer-technician at Mount John who discovered it in systematic checking of plates in June, 1973.

6. AUXILIARY OBSERVING EQUIPMENT.

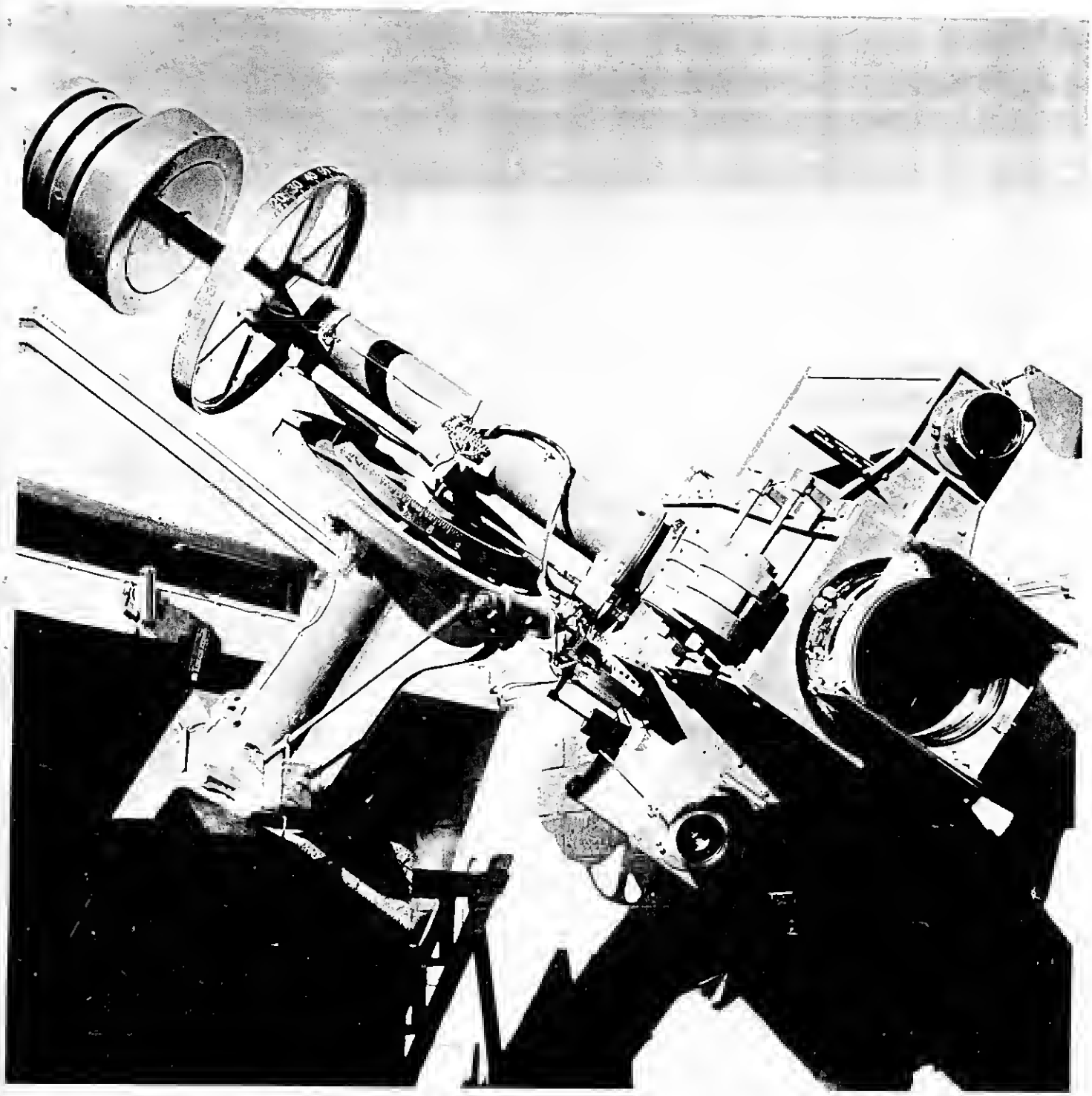
6.1 The Direct Cassegrain Photography Camera is a conventional camera installed by Canterbury to accept standard 102 x 127mm (4 x 5 inch) plates or sheet film, filter holders and broad-band filters, swinging shutter with focussing and tilt mechanisms. It is available for use on both the Boller and Chivens and the Photometric 610mm telescopes.

6.2 The Image Tube Camera developed by Canterbury is available on both the Boller and Chivens and Photometric 610mm telescopes. Varo image intensifier tubes are available with apertures of 40mm. Multi-stage tubes are also available with with a range of broad and narrow band filters. Field guiding is also available.

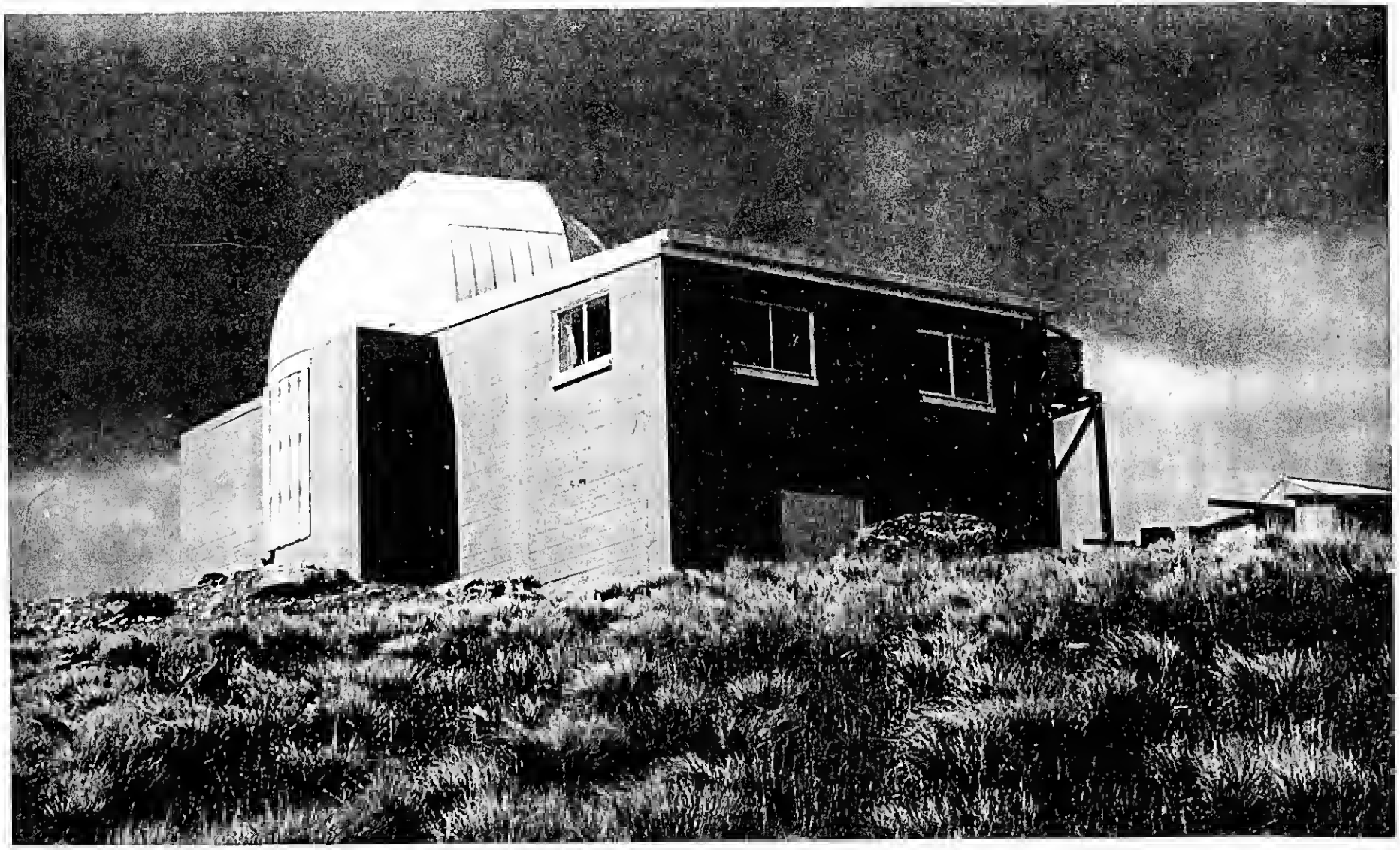


Mount John University Observatory

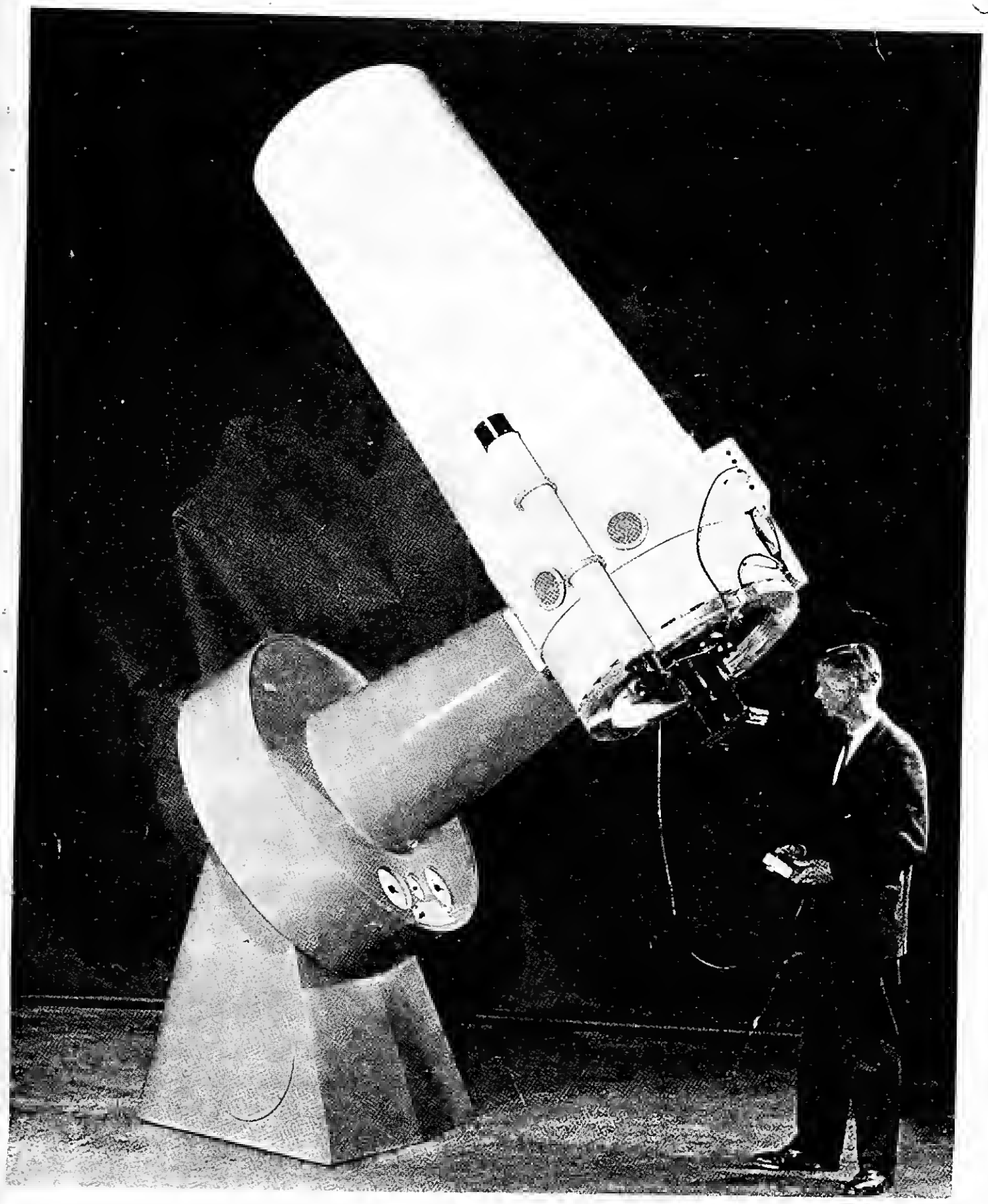
(Aerial view from West)



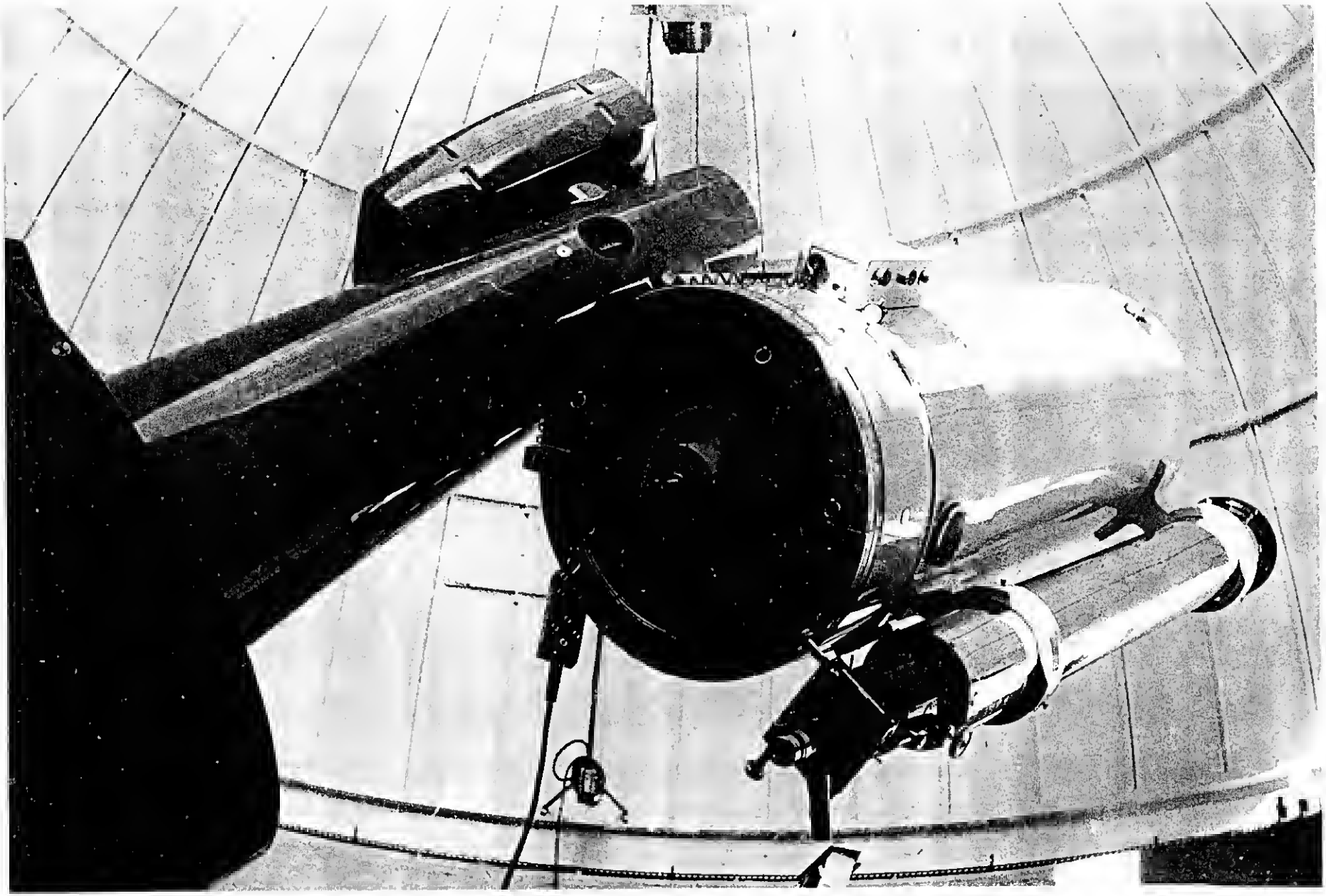
Cook Telescope
(with Survey Camera at top)



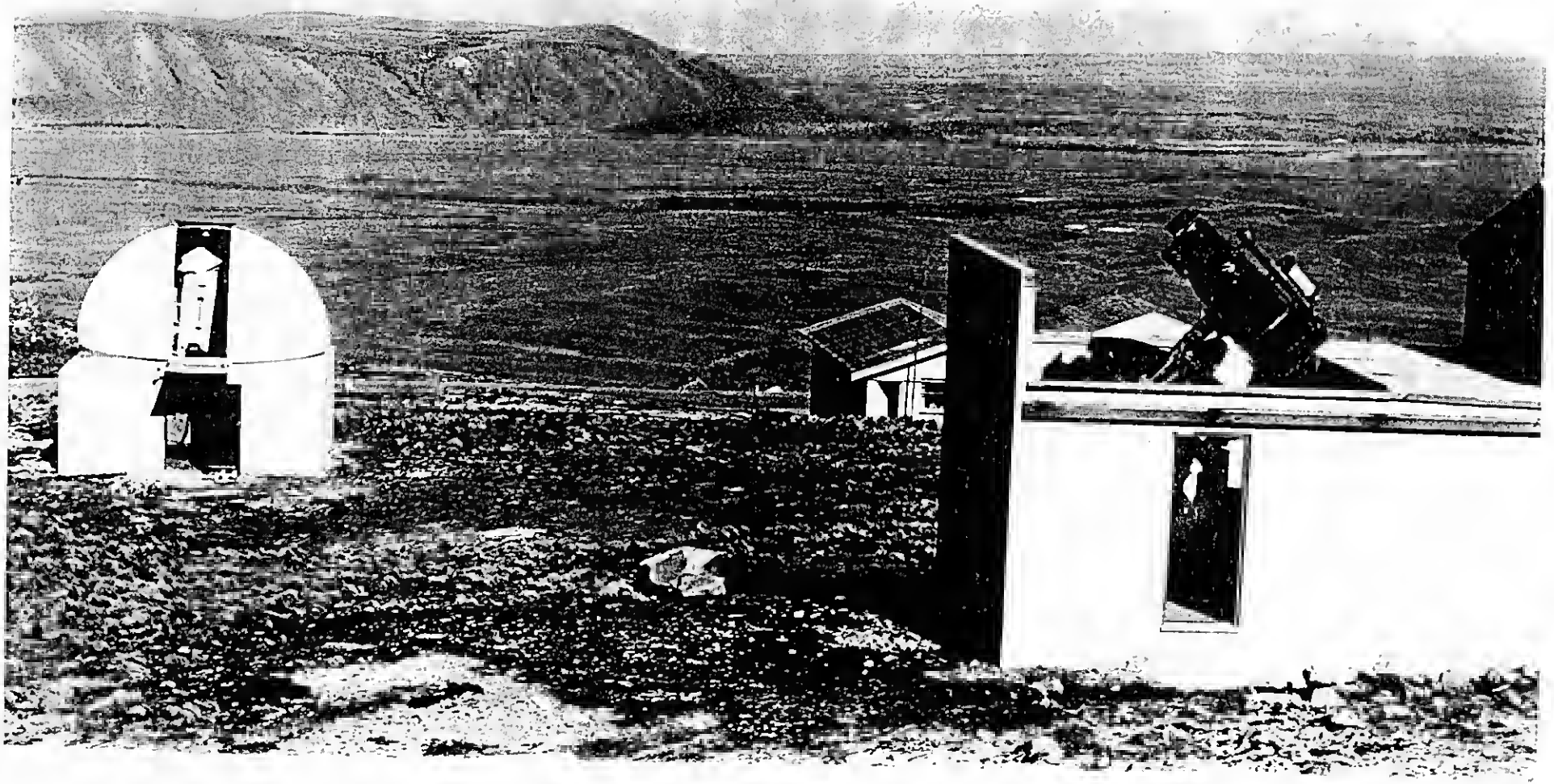
610mm Boller and Chivens Reflector Building
(including darkroom, data-logging room and research area)



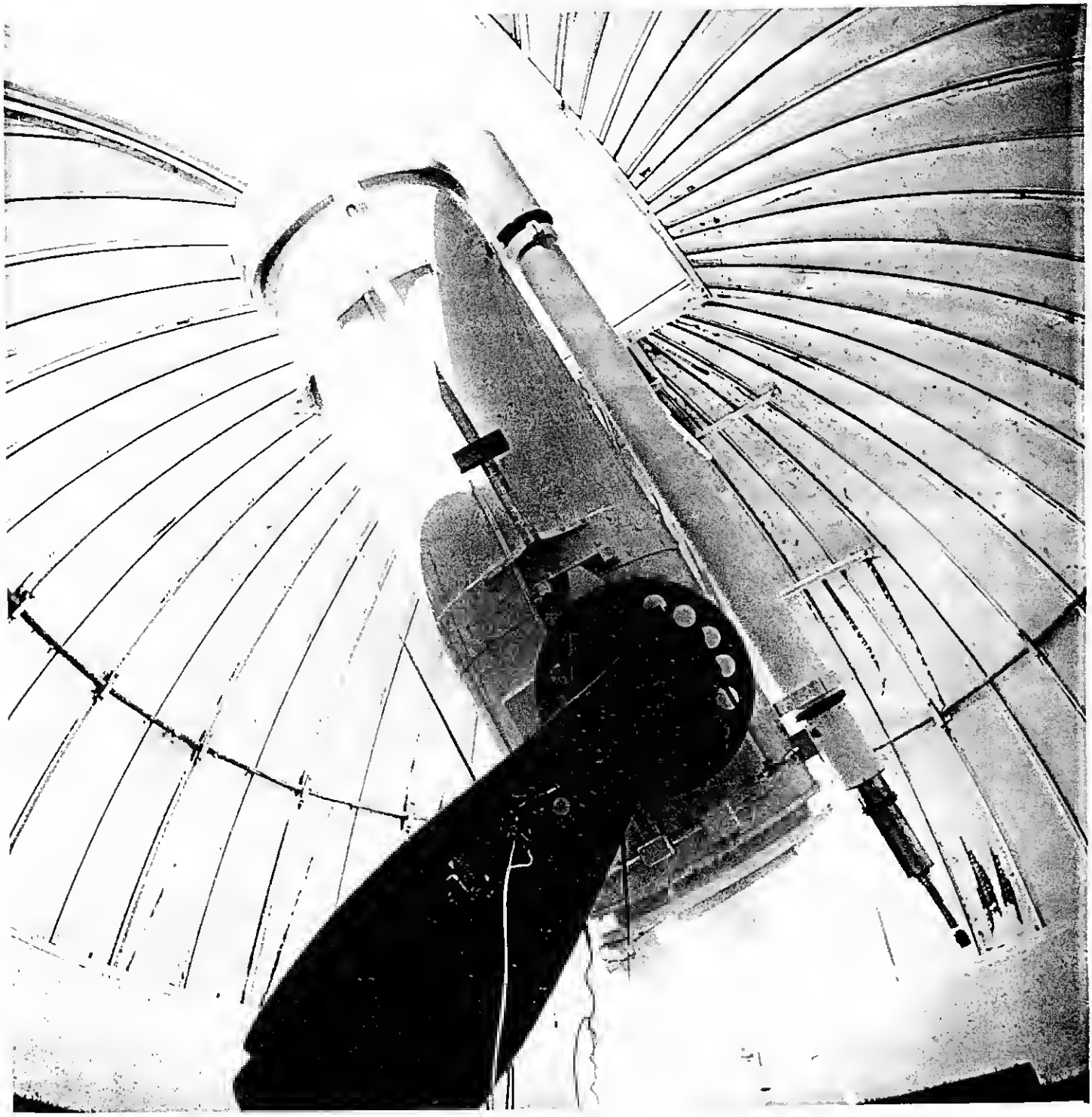
610mm Boller and Chivens Reflector
(displayed at the factory)



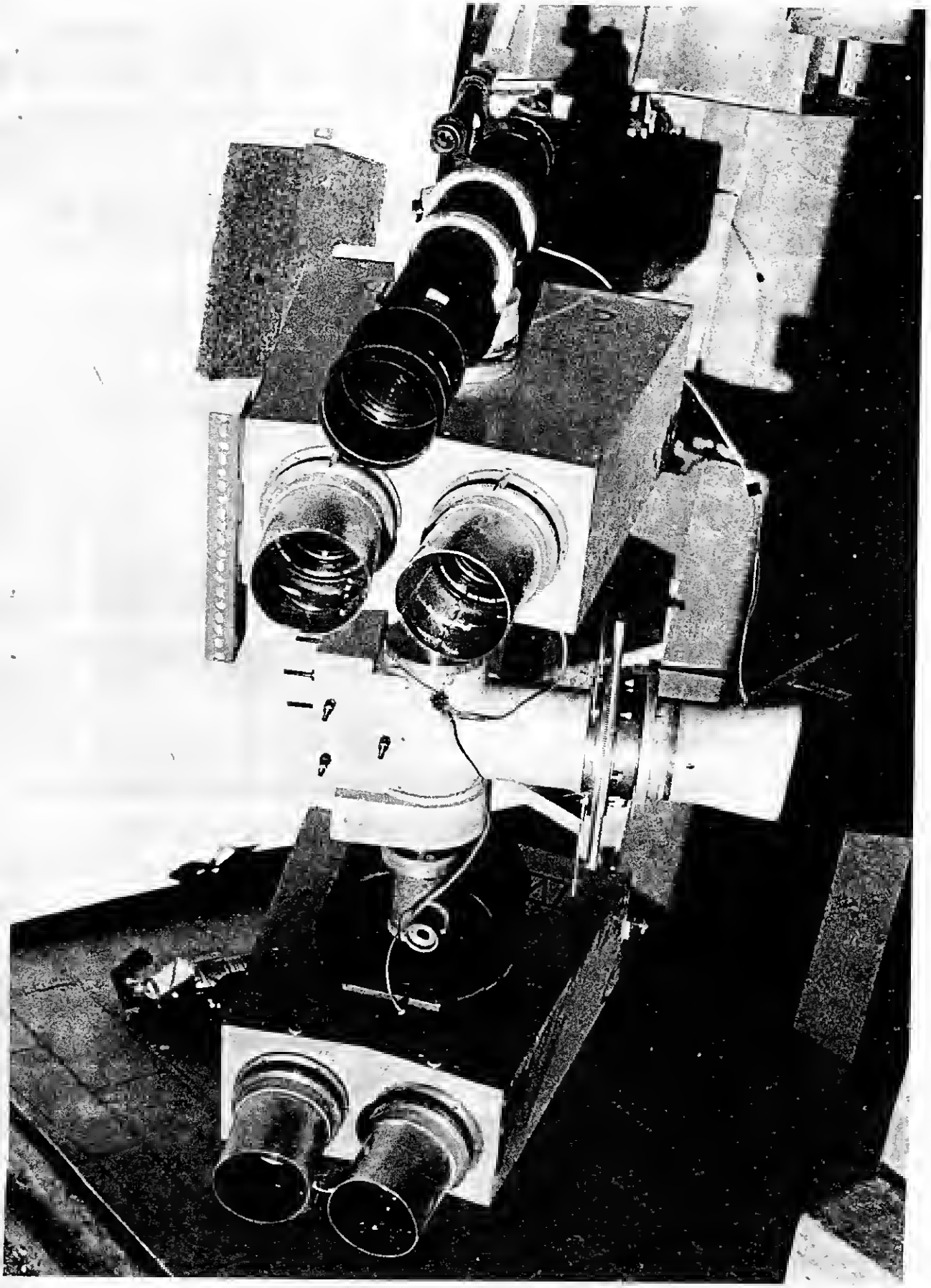
610mm Boller and Chivens Reflector
(installed at the Observatory)



610mm Photometric Reflector (left)
and Cook Telescope (right)



610mm Photometric Reflector



Bamberg Cameras.

6.3 Systems to Facilitate Guiding and Setting. The Photometric Reflector has a 150mm (6-inch) f/15 refractor equipped with off-setting and projection illumination. The Boller and Chivens Reflector has a 200mm (8-inch) refractor also equipped with precision off-setting and projection illumination.

6.4 The Photoelectric Photometer used on the Photometric 610mm Reflector is a complete system including the logging of data on punched cards. Photometer apertures range from 40 to 10 arc seconds and guiding eyepieces give access to the photometer field. A wide range of integration times is available. Excellent photometric conditions at Mount John have permitted stellar variability to be obtained to a few thousandths of a magnitude in the UBV and uvby systems. Limiting magnitude is below 14.0 in the B band (blue). Special filters are available, for example very narrow band and H-beta filters.

6.5 From mid-1976 the following Spectrographs will be available:

(i) A 150mm 10-degree Objective Prism (150 to 300 Å. mm^{-1}).

(ii) A medium-resolution Boller and Chivens Spectrograph for use on both 610mm reflectors (60 or 125 Å. mm^{-1}).

(iii) A high-resolution Échelle Spectrograph, now under construction in the Department of Physics workshops is intended primarily for the Boller and Chivens Reflector. At a dispersion of 2 Å. mm^{-1} a few hours exposure may permit the recording of stars to 8th magnitude using image tubes.

6.6 An objective grating with wide spacing is available for both reflectors and aids the establishment of stellar magnitude sequences to very faint limits.

7. DATA REDUCTION INSTRUMENTS.

Available in the Physics Department are a number of measuring instruments of modern and high quality design. These include a Joyce-Loebl (Mark III) Densitometer which permits direct-intensity measurement of stellar and spectroscopic images and a Spectro-Comparator which can measure the positions of spectrum lines to an accuracy of 0.25 microns. Also available is a Hewlett-Packard Flux-meter and Detector which makes possible sensitometry of photographic material, image-tubes

and other detectors. The Carey Recording Spectrophotometer (Model 14) of the Physics Department is available for calibration of filters and for the spectral sensitivity calibration of photomultipliers.

8. DARKROOMS AND WORKSHOPS.

Both the Observatory and the Physics Department are equipped with extensive mechanical, electronic and optical facilities for service, testing, development and fabrication; full darkroom facilities are available with all the usual processing equipment.

9. ACCOMMODATION.

Accommodation at the Observatory is available for observers and visiting astronomers; a self-contained flat provides excellent accommodation for senior visitors; accommodation for observers and technicians is expanding with the acquisition of two sections in Lake Tekapo township.

10. OTHER SERVICES.

A Seismograph is operated by the staff for the benefit of the N.Z. Seismological service and the Observatory operates a key Weather Station in the N.Z. Meteorological Network. Resident staff provide members of the public wishing to visit the Observatory with a guided tour of the facilities. However, in order to avoid disruption of the research programmes, it is necessary that intending visitors make a prior appointment by contacting the Superintendent, P. O. Box 32, Lake Tekapo, or telephone 813, Lake Tekapo.

11. RESEARCH PROGRAMMES INVOLVING CANTERBURY.

11.1 Sky Survey and Sky Atlas Production. One of the astrographic cameras (of 125mm diameter) was used between 1966 and 1972 in the production of an all-sky photographic survey on 142 glass negatives covering the regions from the

South Pole to $+22\frac{1}{2}^{o}$ North. These plates are available in the Department of Physics for reference when a chart or map is required of very faint stars in any part of the southern sky, for example, to examine regions containing radio sources, novae, faint minor planets, quasars, galaxies and in fact a wide variety of the faint galactic or extra-galactic objects. Each plate covers about 19^{o} by 19^{o} to a magnitude fainter than previously recorded in the southern hemisphere.

The southernmost third of the Survey has been published (1972) in photographic print form as the Canterbury Sky Atlas to permit the bulk of the information on the plates to be directly accessible to observatories, universities and astrophysical institutes throughout the world.

11.2 Photoelectric Photometry. The photoelectric system on the 610mm photometric reflector is used in a wide variety of programmes of astrophysical interest. These include studies of eclipsing binary systems, flare stars, stars in clusters, post-nova stars, and in fact stellar systems in any evolutionary state, variable and non-variable.

11.3 Photographic Photometry. Both direct Cassegrain and image-tube photography is undertaken of regions containing variable quasi-stellar objects; short and long-term variability is studied; narrow-band photometry permits study of continuum variations during optical outbursts. Correlations with radio outbursts are investigated. The camera will also be used in multicolour photographic photometry of cluster stars and other systems of interest in the theories of stellar structure and evolution. Near-infra-red photography may be included in the programmes and hypersensitization equipment is available.

11.4 Patrol Photography. The Bamberg Cameras have been operated in collaboration with Remeis Observatory and the University of Florida in the discovery of variable stars. Some of the variable stars discovered and classified in this way then become the object of more intense individual investigation by high-precision photoelectric photometry, for example on the 610mm reflectors at the Observatory. Comet Clark 1973i was discovered during the operation of this programme by a Mount John Observer-technician, M. Clark, during 1973.

11.5 Observational spectroscopy is scheduled to start in 1976 for Canterbury programmes in stellar abundances of the elements and properties of stellar atmospheres in general.

12. ASTRONOMY AND ASTROPHYSICS TEACHING AT CANTERBURY.

The operation of Mount John University Observatory by the University of Canterbury is closely associated with the development of undergraduate and graduate teaching of astronomy and astrophysics in the Department of Physics as well as with graduate astrophysical research, both observational and theoretical.

The first full-year courses in astronomy available in a New Zealand University, Astronomy 101 (General Astronomy) and Astronomy 102 (Astronomy and Astrophysics) each with two hours of classes and two hours of laboratory per week, have been taught since 1967. In addition, astrophysics is included in parts of courses within the ordinary and Honours B.Sc. degree in Physics. These part courses have included, since 1972, an optional astrophysics paper on stellar physics, cosmic radio source physics and stellar spectroscopy for final-year students in the physics honours school. Graduate student candidates for M.Sc. and Ph.D. degrees, whether in any branch of physics or specialising in an astrophysical field, may take post-graduate lectures in astrophysics topics that vary from year to year.

Research and teaching closely related to astronomy and astrophysics is also carried out in other Departments at Canterbury. These include relativity, cosmology and stellar dynamics in the Mathematics Department and speckle interferometry and antennae theory in the Department of Electrical Engineering.

New Zealand students wishing to become candidates for post-graduate degrees at Canterbury using the equipment at the Observatory must normally enrol for degrees in Physics at the University after completing a suitable undergraduate degree, which need not necessarily be in Physics or at Canterbury.

However, the equipment at the Observatory could also be used by staff and graduate students from other departments at Canterbury, such as Mathematics or Electrical Engineering, limited only by the amount of observing time that can be made available without causing interference to long-term projects in the Department of Physics.

13. NATIONAL RESEARCH FACILITY FOR OPTICAL ASTRONOMY.

The existing capital development, the existence of resources in personnel and workshops on-site and at the major parent institution, the size and the quality of the site and the availability of its instruments for observers from other institutions, limited only by the number of telescopes installed, makes Mount John the natural site for future growth of national optical observing facilities.

14. OBSERVATORY STAFF (1975).

Director:

Head, Department of Physics, University of Canterbury.

Academic Staff in Astronomy and Astrophysics at Canterbury:

Dr. N.A. Doughty, Senior Lecturer in Physics

Dr. J.B. Hearnshaw, Lecturer in Physics

K.H. Fea, Lecturer in Physics

Technical Staff resident at the Observatory:

D.B. Mabin, Superintendent

E.J.A. Baker, Head Technician

M. Clark, Observer-Technician

R.R.D. Austin, Observer-Technician

Technical Staff in Christchurch:

G. Kershaw, Technician

In addition the facilities are available and used by other staff in the Physics Department working in fields related to astronomy, for example radio observations of the upper atmosphere by means of radar detection of meteors.